

Strong interplay between transmission pathways in subwavelength hole arrays in phonon-polaritonic thin films

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We report that phonon-polaritonic thin films with a periodic array of subwavelength holes allow near-complete transmission in the polariton gap, where a homogeneous film completely suppresses transmission.

We find that both propagating modes inside the subwavelength holes and surface resonances on the film interfaces play a crucial role in the transmission behavior. In the frequency range where both occur simultaneously, they interfere destructively and completely suppress transmission. When both pathways are spectrally separated, each individually results in enhanced transmission.

We discuss how the behavior exhibited by phonon-polaritonic films at mid-infrared wavelengths is qualitatively different from the behavior of subwavelength patterned plasmonic thin films in the visible and near-infrared wavelength range.